

# SIEMENS

## POLYDOROS SX/LX

**AX**

### Maintenance Instructions

POLYDOROS

Generator

Also for:

PL SX 50/80

PL SX 65/80

PL LX 30/50 / 30/50 Lite

PL LX 80

The protocol RX63-055.832.02.02.02 is required for these instructions

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## Table of Contents

<b>1</b>	<b>Prerequisites / Notes</b>	<b>4</b>
	Requirements . . . . .	4
	Notes . . . . .	5
	Safety Information . . . . .	5
	Product-specific Remarks . . . . .	5
	General Remarks . . . . .	6
<b>2</b>	<b>General Visual Check</b>	<b>8</b>
	Visual Inspection . . . . .	8
	Tables and Warning Labels . . . . .	9
<b>3</b>	<b>Cleaning the Components</b>	<b>10</b>
<b>4</b>	<b>POLYDOROS SX/LX</b>	<b>11</b>
	Special Requirements . . . . .	11
	Required Documents . . . . .	11
	Required Tools, Test Equipment and Aids . . . . .	11
	Required Materials . . . . .	11
	Product-specific Safety Information . . . . .	11
	Work Time/Maintenance Interval . . . . .	11
	Inspection and Maintenance. . . . .	13
	General Information . . . . .	13
	Generator Control Console . . . . .	13
	Error Log . . . . .	13
	Checking the High Voltage Cables . . . . .	13
	Replacing the Batteries with PL SX 65/80 with XCU HD Unit, Part No.: 38 27 123 . . . . .	14
	Direct Technique Radiation Displays . . . . .	14
	Indirect Technique Radiation Displays . . . . .	14
	IONTOMAT Limit . . . . .	15
	Dose Rate IQ Initial Values. . . . .	15
	Indirect Technique Dose Rate . . . . .	15
	Direct Technique Dose Rate. . . . .	15
	Conditioning the X-Ray Tube(s) . . . . .	16
	IQ Final Test with Indirect Technique . . . . .	17
	IQ Final Test with Direct Technique . . . . .	17
	IONTOMAT Fields . . . . .	18
<b>5</b>	<b>Final Work Steps</b>	<b>20</b>
	Special Requirements . . . . .	20
	Inspection and Maintenance. . . . .	21
<b>6</b>	<b>Changes to Previous Version</b>	<b>22</b>

## 1 Prerequisites / Notes

### 1.1 Requirements

<b>NOTE</b>
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During maintenance on the product, the work steps in the certificate must be documented accordingly.

Maintenance is divided into chapters (as a rule, max. 6 hours for components). Since there can be the same component more than one in a customer system, the component checkpoints in the certificate are listed accordingly. Each component must then be entered with the Part Number and Serial Number. There are also "options" in the customer system. The options must be checked marked accordingly in the certificate.

With parts that must be replaced periodically (battery/steel cables...), the startup date or the last replacement date must be entered to ensure the ability to track the dates. As a rule, the date can be found in the User Handbook (Handover Protocol / old Maintenance Certificate).

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#### Required Documents

- Maintenance Protocol
- See also the individual chapters.

## 1.2 Notes


### 1.2.1 Safety Information

#### 1.2.1.1 General Safety Information

When carrying out the work steps and checks, the general safety information contained in ARTD (General Guidelines for Technical Service) must be observed.



**Dangerous X-radiation during checks and adjustment work steps.  
Risk of death or serious bodily injury.**

⇒ **For checks and adjustments that must be performed with radiation switched on, the prescribed radiation safety measures must be observed (see also ARTD-002.731.02... and ARTD-002.731.38... General Guidelines for Technical Service). These checks and adjustments are explicitly labeled on the following pages with the radiation warning symbol .**

**NOTE**

**The particular applicable and current ARTDs (General Guidelines for Technical Service) can be found on the Intranet.**

#### 1.2.1.2 Product-specific Safety Information

When carrying out the work steps and checks, the product-specific safety information contained in the documents must be observed.

### 1.2.2 Product-specific Remarks

The illustrations and drawings may differ slightly depending on the actual system.

#### 1.2.2.1 Notes Regarding Maintenance

Damaged or worn parts may be replaced only with original parts. The Inspection and Maintenance Checklists must be filled out and signed by the Maintenance Technician. Repair work and work steps that are not listed in the checklists must be listed separately.

**NOTE**

**Replace damaged parts in discussion with the customer.**

### 1.2.3 General Remarks

#### 1.2.3.1 Maintenance time / interval

The maintenance time and the maintenance interval is listed in each chapter for a component or in the general chapters.

The completion times for cyclical replacement of parts, e.g. cables or spring-loaded mechanisms, etc. are not included in these Maintenance Instructions.

The work time can be viewed only as a reference value, because the time for e.g. cleaning can vary widely.

#### 1.2.3.2 Tolerance Data

General tolerances for linear dimensions per ISO 2768

These tolerances apply for all dimensions listed in these instructions as long as no other tolerance is expressly listed next to the value.

Limit value for the nominal range	over 3 mm to 6 mm	over 6 mm to 30 mm	over 30 mm to 120 mm	over 120 mm to 400 mm	over 400 mm to 1000 mm	over 1000 mm to 2000 mm	over 2000 mm to 4000 mm
Adm. tolerance	<b>± 0,5 mm</b>	<b>± 1 mm</b>	<b>± 1,5 mm</b>	<b>± 2,5 mm</b>	<b>± 4 mm</b>	<b>± 6 mm</b>	<b>± 8 mm</b>

#### 1.2.3.3 Maximum Torque Values in Nm

Nominal thread diameter		Screw material						
		Iron/steel per DIN 267						Brass CuZn alloy
	Hardness rating	4.6	4.8	5.8	<b>8.8</b>	10.9	12.9	
M 3		0,5	0,67	0,83	<b>1,3</b>	1,9	2,2	0,62
M 3.5		0,76	1,0	1,3	<b>2,0</b>	2,8	3,4	0,95
M 4		1,1	1,5	1,9	<b>3,0</b>	4,2	5,1	1,4
M 5		2,2	3,0	3,7	<b>6,0</b>	8,4	10,1	2,8
M 6		3,8	5,1	6,4	<b>10,2</b>	14,4	17,3	4,8
M 8		9,5	12,6	15,8	<b>25,3</b>	35,6	42,7	11,9
M 10		18,7	24,8	31,1	<b>49,8</b>	70,0	84,0	23,3
M 12		32,9	43,8	54,8	<b>87,6</b>	123,3	147,9	41,1

If no other information is provided, use the corresponding torque values for hardness rating 8.8 when checking torque values!

A tolerance of  $\pm 10\%$  is permitted for torque values.

**1.2.3.4 Explanation of Abbreviations in the Maintenance Certificate**

Abbrevia- tion	Explanation
SI	Safety Inspection
SIE	Electrical Safety
SIM	Mechanical Safety
PM	Preventive Maintenance
PMP	Periodic Preventive Maintenance
PMA	Maintenance, Preventive Adjustments
PMF	Preventive Check of Operating Values and of Functions
Q	System Quality, Image Quality
QIQ	Image Quality
QSQ	System Quality
SW	Software Maintenance
CSE	Customer Service Engineer
KSK No.	Customer-specific Code
IVK	Installed Volume Component
WE	Maintenance Unit

**1.2.3.5 DHHS Regulations**

This document does **not** replace the DHHS Maintenance Instructions “Maintenance Instructions/Measurement Certificate” in countries with DHHS Regulations.

## 2 General Visual Check

### 2.1 Visual Inspection

#### SI Checking the cover panels

- All required cover panels present.
  - Check the cover panels for visible damage, sharp edges or cracks.

#### SI Required operator documents present

- Are the required operator documents complete, present, legible?
  - In new systems, there is a list with the documents that are shipped in the System Binder.
  - Based on this list, completeness can be checked easily.
  - **The following always applies:** All required user instructions, supplements and safety notes must be present for **use** of the system.

#### SI Checking the cable corrugated hoses

- The cables (corrugated hoses) may not have any cracks in the insulation.
- Check the corresponding strain reliefs or cable shielding connections.
  - The check refers only to laid cables that are visible and to the way in which they are laid!

#### SI Checking the cable corrugated hoses (of mobile components)

- Check the way in which cables are laid (corrugated hoses) to mobile components.
  - The cables should not pose a risk of tripping and should not be laid over any sharp edges.
  - The check refers only to laid cables that are visible and to the way in which they are laid!

#### SI Checking the radiation protective panels

- To the extent configured, visually check the following radiation protective covers for cracks or other damage:
  - Radiation protection cover panels
  - Lead rubber flaps
  - Ceiling-mounted radiation shield
  - Any additional radiation shields that can be installed
  - Movable radiation shield

#### SI Checking warning labels

- All warning stickers that indicate a risk (operator, patient or unit) that can occur during operation of the system must be present and legible.
  - e.g.: crushing of fingers, crushing of feet, lasers, maximum load.



## 2.2 Tables and Warning Labels

<b>POLYDOROS</b>	
<b>Where?</b>	<b>Fig.</b>
In the vicinity of the generator on/off switch or system on / off switch.	Generator ON

- For the corresponding pictogram (picture name) and part number, see "Warning Labels, AX00-000.820.03..."

### 3 Cleaning the Components

#### Required Tools, Test Equipment and Aids

- Hakapur cleaning concentrate (500 g), cleaning agent for plastic, glass and enameled parts 96 60 648 RH999
- WD40 contact spray (spray bottle, 400 g), cleaning agent and rust protection for rails 28 70 061
- Alcohol n.a.
- Lint-free cleaning cloths n.a.
- Brush to remove dust n.a.

#### Cleaning and General Remarks

<b>NOTE</b>
-------------

Depending on the component, observe the applicable points.

#### PM Inspection of internal heat dissipation

- Clean all ventilation grids.
- Check all fans for function.

#### PM Cleaning

- Remove collected dust inside of the particular components.
- Remove soiling that is not accessible to the customer's cleaning personnel during maintenance work.

<b>NOTE</b>
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For hygienic reasons, wear rubber gloves while cleaning.

- Soften contrast medium with water only and remove it.
- After completing maintenance work, remove soiling from enameled and anodized parts with WD40 contact spray, enamel cleaning agent or Hakapur.

## 4 POLYDOROS SX/LX

### 4.1 Special Requirements

#### 4.1.1 Required Documents

- Generator User Instructions
- Generator Startup Instructions

#### 4.1.2 Required Tools, Test Equipment and Aids

- |                                     |           |
|-------------------------------------|-----------|
| • Copper filter set (10 x 0.3 Cu)   | 44 06 120 |
| • 2.1 mm precision radiation filter | 99 00 598 |
| • Multimeter, e.g. Fluke 8060A      | 97 02 101 |
| • mAs meter                         | 81 60 400 |

#### Paints (to touch up chips/scratches in the paint finish)

- |                                |           |
|--------------------------------|-----------|
| • White (spray can)            | 84 27 734 |
| • White textured (paint stick) | 34 44 403 |

#### 4.1.3 Required Materials

##### POLYDOROS SX 65/80

- |  |           |
|--|-----------|
| • Silicon oil, AK350                   | 17 87 035 |
| • Filter matting (Touchscreen console) | 11 71 722 |

##### Also for POLYDOROS SX 65/80 with XCU HD Unit, Part No.: 38 27 123

- |                             |           |
|-----------------------------|-----------|
| • Battery (interval 1 year) | 46 97 611 |
|-----------------------------|-----------|

#### 4.1.4 Product-specific Safety Information

- See Generator Startup Instructions

#### 4.1.5 Work Time/Maintenance Interval

- Generator only with direct technique: approx. 80 minutes / 12 months<sup>1</sup>
- Generator only with indirect technique: approx. 40 minutes / 12 months

- Generator with direct technique and indirect technique: approx. 2 hours / 12 months<sup>1</sup>

---

1. Depending on the number of tube units and work stations

## 4.2 Inspection and Maintenance

### 4.2.1 General Information



Even after switching off the radiographic system, electrical voltage is still present in the generator.

If not observed, death or serious bodily injury can occur.

- ⇒ Read and observe the warning labels in the cabinets.
- ⇒ Switch power off to the radiographic system and to the on-site power supply and secure them against switching power back on.
- ⇒ Wait until all LEDs in the generator go off (at least 5 minutes).

#### PM Cleaning

See [\(Cleaning the Components / p. 10\)](#)

### 4.2.2 Generator Control Console

#### PM Cleaning

- Replace the filter matting on the back of the touchscreen console.

### 4.2.3 Error Log

#### PM Evaluating the Error Log

- Read out and evaluate the error log.
- Initiate any required corrective measures.
- Clear the ERROR log.

### 4.2.4 Checking the High Voltage Cables

#### SI Check the shielding on the HV cables.

- Pull the high voltage cables connected to the high voltage transformer out of the sockets.

#### NOTE

If the shielding braid is to be grounded in the generator cabinet, remove the grounding cable for the measurement.

- Measure the shielding braid against ground; when doing this, move the cable, particularly where it is bent or looped.
  - ⇒ Required: maximum 1 Ohm/m
- If necessary, replace the high voltage cables.

- Check the high voltage connectors and sockets for damage (burn marks, cracks).
- Check the oil level in the sockets.
  - ⇒ Required: 1 - 1.5 cm
- If needed, refill the oil (do not mix oils). To do this, first remove remaining oil with a lint-free cloth.
- Reinsert the cables.
  - Use only oil, do not insert any corona disks!

#### 4.2.5 Replacing the Batteries with PL SX 65/80 with XCU HD Unit, Part No.: 38 27 123

##### **PMP Battery replacement performed (required annually) with the PL SX 65/80**

The battery connection in the XCU HD unit is present twice so that the new battery can be installed.

- Install the new battery in the XCU HD unit.
- Remove the used battery.
- Place an adhesive label with the date of the battery replacement on the XCU HD unit housing.

#### 4.2.6 Direct Technique Radiation Displays



##### **Checking the Direct Technique Radiation Displays**

- Trigger an exposure at 40 kV - 1.25 mAs, large focus and 100%.
  - ⇒ If present, the radiation display on the control console and in the examination room must go on briefly.
  - ⇒ The signal must be audible at the place where the unit control console is located.
- Select 40 kV, 20 mAs, 2 s.
- Trigger exposure and immediately release the trigger switch.
  - ⇒ Exposure must be immediately interrupted.



#### 4.2.7 Indirect Technique Radiation Displays



##### **Checking the Indirect Technique Radiation Displays**

- Trigger a single exposure.
  - ⇒ If present, the radiation display on the control console and in the examination room must go on briefly.
  - ⇒ The signal must be audible at the place where the unit control console is located.
- Switch fluoroscopy **ON** at the fluoro unit.
  - ⇒ If present, the radiation display on the control console and in the examination room must briefly go on.



## 4.2.8 IONTOMAT Limit

### SI Checking the IONTOMAT Limit



- Completely close the collimator.
- Select IONTOMAT and 40 kV.
- Cover over the selected IONOTOMAT measurement fields with absorbers (lead aprons) or pivot the X-ray tube unit in a different direction.
- Trigger exposure.
  - ⇒ Radiation is stopped after 0.1 s.
  - ⇒ ERROR 550 is displayed.

## 4.2.9 Dose Rate IQ Initial Values

If values for indirect dose control are not yet present in the system, the dose must be measured directly one time. See the IQ Test Procedure.

## 4.2.10 Indirect Technique Dose Rate

### QIQ Indirect Technique IQ Initial Values

Indirect Control of the Fluoroscopy Dose Rate at the I.I. Input



- Switch the system on and wait until the system is ready.
- Select the following adjustment parameters (to the extent configured \*1):
  - Set the max. SID \*1.
  - Select I.I. full format.
  - Completely open the collimator.
  - Move the grid in to the beam path \*1.
  - Place the 2.1 mm Cu precision radiation filter in front of the collimator.
  - Select the Fluoro 1 dose rate step and continuous fluoro.
  - Do not select any additional filtering at the collimator \*1.
- At the unit, switch fluoro "on" and let it stabilize.
- Make a note of the fluoro kV and mA post display (Generator Indirect Technique table, "Prior to Conditioning the X-Ray Tube").
  - ⇒ These values will be checked again during the final tests.

## 4.2.11 Direct Technique Dose Rate

### QIQ Direct Technique IQ Initial Values

**NOTE**

**Perform this check at each work station!**

Perform the cutoff dose for direct exposure (indirect dose control) for all workstations with the IONOTOMAT.

- For workstations with cassette technique:  
Insert an 18x24 cm (8 x 10") cassette without film into the spotfilm device.
- For work stations with RAD (exposure detector):  
Set the collimation to at least 18x24 cm (8" x 10").
- Select the following adjustment parameters:
  - Set the max. SID.
  - Select the cassette system.
  - Move the grid in to the beam path.
  - Select IONTOMAT, middle measuring field, 77 kV.
  - Select the "U" screen, correction = 0, small focus, 80%.
  - Do not select any additional filtering at the collimator.
  - Place the 2.1 mm Cu precision radiation filter in front of the collimator.
- Trigger exposure.
- Make a note of the mAs value and kV value post display (Generator Direct Technique table, "Prior to Conditioning the X-Ray Tube").
  - ⇒ These values will be checked again during the final tests.



#### 4.2.12 Conditioning the X-Ray Tube(s)

##### **PMA Conditioning the tube(s) (test shots)**

For POLYDOROS SX 65/80 or LX:

- See the generator SSW.

POLYDOROS SX 50/80 or IT

- See the Startup Instructions.

##### **PM Check of the max. generator power**

<b>NOTE</b>
-------------

**Can be skipped if the the loop impedance was measured in the system (e.g. during the Safety-technical Check).**

- With POLYDOROS SX or LX:  
Select the "XCS-Service Application-Main Program/Components/Polydoros .../Polydoros .../Service/Diagnostic/ Nominal Power" menu.
- With the POLYDOROS IT:  
See the Startup Instructions.
- Connect the mAs meter to the generator.
- Select the following parameters:
  - Tube 1





- Large focus
- 100 kV
- 65 mAs (65 kW) or 80 mAs (80 kW)
- 3-point technique
- 100 ms
- Trigger exposure.
- Calculate the max. power from the measured mA and the kV that was set.

$$P_{\text{max.}} = \frac{\text{kV} \times \text{mA}}{1000}$$

- The calculated max. generator power must match the values in the Test Certificate or Quality Certificate, max. admissible tolerance 10%.

#### 4.2.13 IQ Final Test with Indirect Technique

##### QIQ IQ Final Test

Indirect Control of the Fluoroscopy Dose Rate at the I.I. Input

- Switch the system on and wait until the system is ready.
- Select the following adjustment parameters (to the extent configured \*1):
  - Set the max. SID \*1.
  - Select I.I. full format.
  - Completely open the collimator.
  - Move the grid in to the beam path \*1.
  - Place the 2.1 mm Cu precision radiation filter in front of the collimator.
  - Select the Fluoro 1 dose rate step and continuous fluoro.
  - Do not select any additional filtering at the collimator \*1.
- Switch fluoro **ON** and let it stabilize.
- Make a note of the fluoro kV and mA post display (Generator Indirect Technique table, "After Conditioning the X-Ray Tube").
  - Find the tolerance in the IQ Test Certificate.



#### 4.2.14 IQ Final Test with Direct Technique

##### QIQ IQ Final Test

Perform the cutoff dose for direct exposure (indirect dose control) for all workstations with the IONOTOMAT.

- For workstations with cassette technique:  
Insert an 18x24 cm (8 x 10") cassette without film into the spotfilm device.

- For work stations with RAD (exposure detector):  
Set the collimation to at least 18x24 cm (8" x 10").
- Select the following adjustment parameters:
  - Set the max. SID.
  - Select the cassette system.
  - Move the grid in to the beam path.
  - Select IONTOMAT, middle measuring field, 77 kV.
  - Select the "U" screen, correction = 0, small focus, 80%.
  - Do not select any additional filtering at the collimator.
  - Place the 2.1 mm Cu precision radiation filter in front of the collimator.
- Trigger exposure.
- Make a note of the mAs value and kV value post display (Generator Direct Technique table, "After Conditioning the X-Ray Tube").
  - Find the tolerance in the IQ Test Certificate.



#### 4.2.15 IONTOMAT Fields

PM

##### Selecting and checking the sensitivity of the IONTOMAT fields

**NOTE**

**Perform this check at each work station!**

Can be skipped if there is a regular constancy test!

Only with three-field chambers

For exposures using the side fields, the difference from the middle chamber may be  $\pm 20\%$  for dose or 0.2 exposure points for the film density.

- Select IONTOMAT and 73 kV.
  - Collimate so that all measuring fields are exposed.
  - Insert 0.6 mm Cu into the beam path.
  - Select the middle measuring field.
    - Cover over the two other fields (lead apron).
    - Trigger exposure.
    - Read and make a note of the mAs post display (Generator Direct Technique table, Iontomat Fields).
  - Select the left measuring field.
    - Cover over the two other fields (lead apron).
    - Trigger exposure.
    - Read and make a note of the mAs post display (Generator Direct Technique table, Iontomat Fields).
- ⇒ The mAs post display for the exposures with the side measuring fields may not differ by more than  $\pm 20\%$  from the middle measuring field.





- Select the right measuring field.
  - Cover over the two other fields (lead apron).
  - Trigger exposure.
  - Read and make a note of the mAs post display (Generator Direct Technique table, Iontomat Fields).
- ⇒ The mAs post display for the exposures with the side measuring fields may not differ by more than  $\pm 20\%$  from the middle measuring field.



- Select all measuring fields.
  - Trigger exposure.
- ⇒ The mAs post display may not differ by more than  $\pm 20\%$  from the middle chamber.

## PM Checking IONTOMAT linearity

### NOTE

**Perform this check at each work station!**

The IONTOMAT should hold the dose constant at the image intensifier, regardless of the object thickness, object density and radiation intensity.

If there is a linear increase in the object thickness of 0.3 mm Cu in each instance (with conditions that otherwise remain constant), the dose rate at the IONTOMAT chamber is decreased by half at 60 kV. To achieve the correct cutoff dose, the mAs values are doubled in each instance.

Dose = dose rate x time



- Select IONTOMAT, 60 kV and middle measuring field.
- Collimate so that all measuring fields are exposed.
- Trigger exposure with 0.3 mm Cu in the beam path.
- Read and make a note of the mAs post display (Generator Direct Technique table, Linearity).



- Trigger exposure with 0.6 mm Cu in the beam path.
- Read and make a note of the mAs post display (Generator Direct Technique table, Linearity).



- Trigger exposure with 0.9 mm Cu in the beam path.
- Read and make a note of the mAs post display (Generator Direct Technique table, Linearity).
- ⇒ The mAs values must double in each instance. Admissible tolerance  $\pm 20\%$ .

## 5 Final Work Steps

### 5.1 Special Requirements

#### Required Documents

- n.a.

#### Required Tools, Test Equipment and Aids

- Ground wire test meter (the test meter must meet the specifications of IEC 61557/EN 61557/VDE 0413).

For example: SECUTESTSIII general purpose test meter or PROFITEST 0100S-II \*

\*Order directly from:

GOSSEN METRAWATT GmbH

Thomas-Mann-Str. 16-20

D-90471 Nürnberg

Germany

Telephone +49 911 8602-0

Fax +49 911 8602-669

E-mail: [info@gmc-instruments.com](mailto:info@gmc-instruments.com)

<http://www.gmc-instruments.com>

#### Required Materials

- n.a.

#### Product-specific Safety Information

- n.a.

#### Work Time/Maintenance Interval

- 20 minutes / 12 months

## 5.2 Inspection and Maintenance

### Installing the Cover Panels

- Install all cover panels that are not yet installed in the reverse sequence. When doing this, absolutely connect the ground wire if present.

### SIE Performing the Ground Wire Check

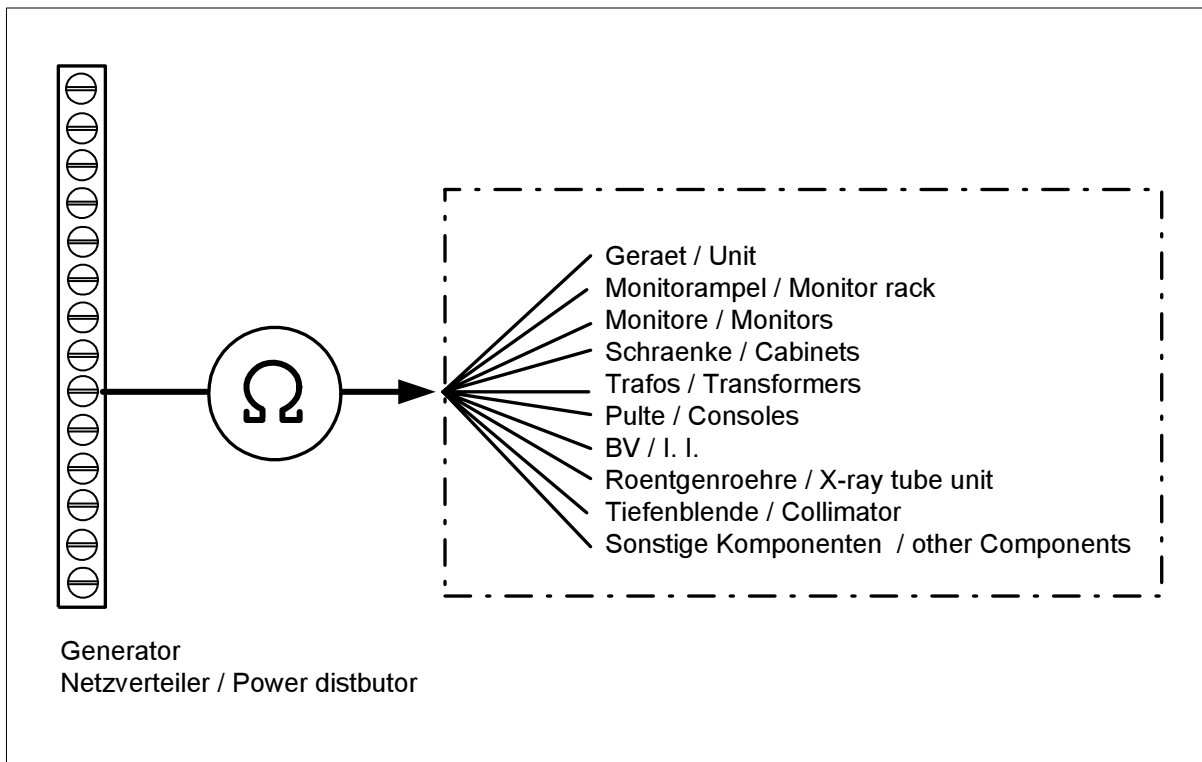


Fig. 1: Ground wire check with fixed power connection

- Switch off power to the system.
- Test procedure:
  - Measure between all conductible parts of the system that can be touched and the ground wire bus rail (e.g. in the generator, power distributor).
    - ⇒ Maximum value: 0,2 Ω (Observe country-specific regulations!)
    - Exception:** Accessory rails on the collimator and tabletop.

## 6 Changes to Previous Version

Chapter	Section	Changes
		Document completely revised.